FINAL CODE

Apply ImageDataGenerator Functionality To Train And Test Set.IPYNB

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
# Training Datagen
train_datagen = ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
# Testing Datagen
test_datagen = ImageDataGenerator(rescale=1/255)
```

```
# Training Dataset
x_train=train_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/training_set',target_size=(64,64), class_mode='categorical',batch_size=900)
# Testing Dataset
x_test=test_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/test_set',target_size=(64,64), class_mode='categorical',batch_size=900)
```

```
Found 15760 images belonging to 9 classes.
Found 2250 images belonging to 9 classes.
```

```
print("Len x-train : ", len(x_train))
print("Len x-test : ", len(x_test))
```

```
Len x-train :  18
Len x-test :  3
```

```
# The Class Indices in Training Dataset
x_train.class_indices
```

```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

Import ImageDataGenerator Library And Configure It.IPYNB

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
# Training Datagen
train_datagen = ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
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[3] Python

```python
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

[4] Python

```python
# Training Datagen
train_datagen = ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
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```

[6] Python

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# Testing Dataset
x_test=test_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/test_set',target_size=(64,64), class_mode='categorical',batch_size=900)
```

```
Found 15760 images belonging to 9 classes.
Found 2250 images belonging to 9 classes.
```

```python
print("Len x-train : ", len(x_train))
print("Len x-test : ", len(x_test))
```

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# Training Dataset
x_train=train_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/training_set',target_size=(64,64), class_mode='categorical',batch_size=900)
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x_test=test_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/test_set',target_size=(64,64), class_mode='categorical',batch_size=900)
```

[6] Python

```
Found 15760 images belonging to 9 classes.
Found 2250 images belonging to 9 classes.
```

```python
print("Len x-train : ", len(x_train))
print("Len x-test : ", len(x_test))
```

[7] Python

```
Len x-train :  18
Len x-test :  3
```

```python
# The Class Indices in Training Dataset
x_train.class_indices
```

[8] Python

```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

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```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

Model Creation

[9] Python

```python
# Importing Libraries
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
```

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[10] Python

```python
# Creating Model
model=Sequential()
```

[11] Python

```python
# Adding Layers
model.add(Convolution2D(32,(3,3),activation='relu',input_shape=(64,64,3)))
```

[12] Python

```python
model.add(MaxPooling2D(pool_size=(2,2)))
```

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[11] Python

```python
# Adding Layers
model.add(Convolution2D(32,(3,3),activation='relu',input_shape=(64,64,3)))
```

[12] Python

```python
model.add(MaxPooling2D(pool_size=(2,2)))
```

[13] Python

```python
model.add(Flatten())
```

[14] Python

```python
# Adding Dense Layers
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
model.add(Dense(9,activation='softmax'))
```

[15] Python

```python
# Compiling the Model
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
```

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```python
# Fitting the Model Generator
model.fit_generator(x_train,steps_per_epoch=len(x_train),epochs=10,validation_data=x_test,validation_steps=len(x_test))
```

[18] Python

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please
use `Model.fit`, which supports generators.


Epoch 1/10
18/18 [==============================] - 92s 5s/step - loss: 0.0049 - accuracy: 0.9994 - val_loss: 0.2635 - val_accuracy: 0.9773
Epoch 2/10
18/18 [==============================] - 90s 5s/step - loss: 0.0040 - accuracy: 0.9995 - val_loss: 0.2074 - val_accuracy: 0.9773
Epoch 3/10
18/18 [==============================] - 87s 5s/step - loss: 0.0041 - accuracy: 0.9995 - val_loss: 0.2460 - val_accuracy: 0.9773
Epoch 4/10
18/18 [==============================] - 91s 5s/step - loss: 0.0041 - accuracy: 0.9992 - val_loss: 0.2470 - val_accuracy: 0.9782
Epoch 5/10
18/18 [==============================] - 88s 5s/step - loss: 0.0037 - accuracy: 0.9993 - val_loss: 0.2439 - val_accuracy: 0.9782
Epoch 6/10
18/18 [==============================] - 88s 5s/step - loss: 0.0024 - accuracy: 0.9997 - val_loss: 0.2852 - val_accuracy: 0.9782
Epoch 7/10
18/18 [==============================] - 91s 5s/step - loss: 0.0023 - accuracy: 0.9997 - val_loss: 0.2589 - val_accuracy: 0.9782
Epoch 8/10
18/18 [==============================] - 93s 5s/step - loss: 0.0014 - accuracy: 1.0000 - val_loss: 0.2523 - val_accuracy: 0.9782
Epoch 9/10
```

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```
18/18 [==============================] - 91s 5s/step - loss: 0.0041 - accuracy: 0.9992 - val_loss: 0.2470 - val_accuracy: 0.9782
Epoch 5/10
18/18 [==============================] - 88s 5s/step - loss: 0.0037 - accuracy: 0.9993 - val_loss: 0.2439 - val_accuracy: 0.9782
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Epoch 8/10
18/18 [==============================] - 93s 5s/step - loss: 0.0014 - accuracy: 1.0000 - val_loss: 0.2523 - val_accuracy: 0.9782
Epoch 9/10
18/18 [==============================] - 92s 5s/step - loss: 0.0013 - accuracy: 0.9999 - val_loss: 0.2269 - val_accuracy: 0.9778
Epoch 10/10
18/18 [==============================] - 91s 5s/step - loss: 0.0012 - accuracy: 0.9999 - val_loss: 0.2968 - val_accuracy: 0.9782

<keras.callbacks.History at 0x7fde26f54590>
```

Saving the Model

```python
model.save('asl_model_84_54.h5')
```

[19]

OneDrive

Screenshot saved

The screenshot was added to your OneDrive.

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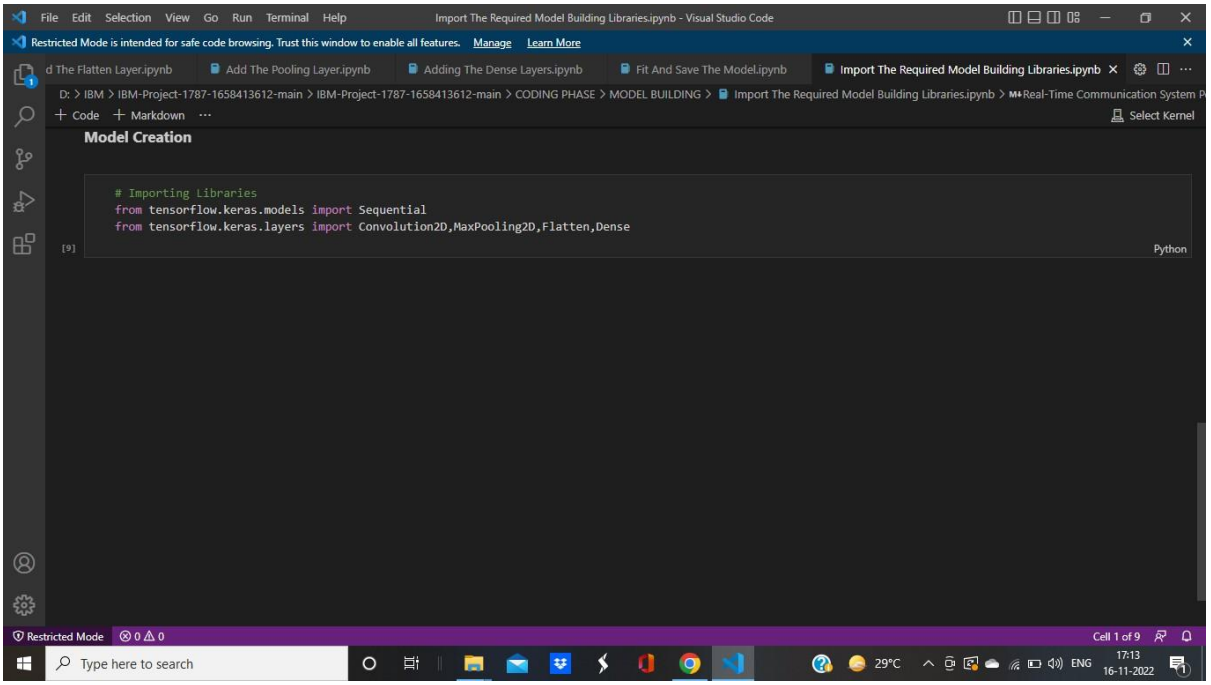
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Model Creation
# Importing Libraries
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from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
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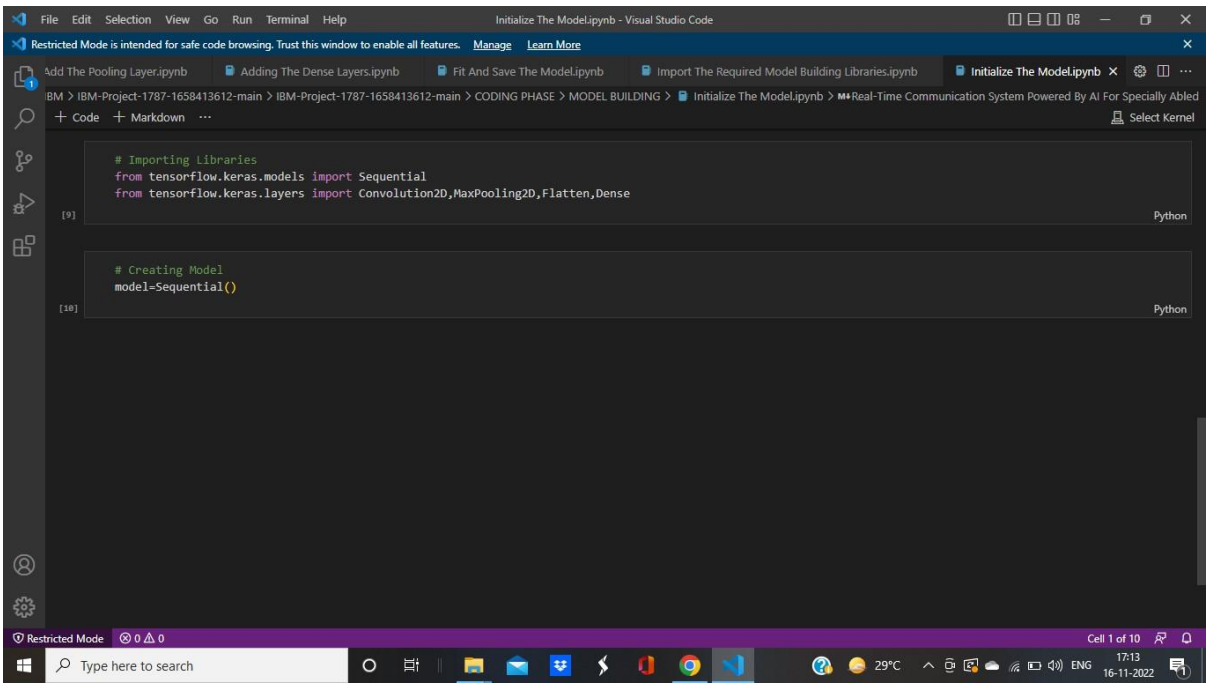
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from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
[9]
Python
# Creating Model
model=Sequential()
[10]
Python
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Language used : Python

Required Packages :

Import numpy as np

Import cv2

Import os

From keras.models import load_model

From flask import flask, render_template, response

Import tensorflow as tf

From gtts import gtts #to convert text to speech

Global graph

Global writer

From skimage.transform import resize

App.py

```
from flask import Flask, Response, render_template
from camera import Video

app = Flask(__name__)
@app.route('/')
def index():
        return render_template('index.html')

def gen(camera):
        while True:
                frame = camera.get_frame()
                yield(b'--frame\r\n'
                        b'Content-Type: image/jpeg\r\n\r\n' + frame +
                        b'\r\n\r\n')

@app.route('/video_feed')
def video_feed():
        video = Video()
        return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary =
frame')
```

```
if __name__ == '__main__':
        app.run()
```

main.py

```
import cv2

video = cv2.VideoCapture(0)

while True:
        ret, frame = video.read()
        cv2.imshow("Frame", frame)
        k = cv2.waitKey(1)
        if k == ord('q'):
                break

video.release()
cv2.destroyAllWindows()
```

Code to preprocess the frame captured from camera :

```
def detect(frame):
    img=resize(frame,(64,64,1))
    img=np.expand_dims(img,axis=0)
    if(np.max(img)>1):
        img=img/255.0
    with graph.as_default():
            prediction = model.predict_classes(img)
    print(prediction)
    pred=vals[prediction[0]]
```

camera.py

```
import cv2
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image

class Video(object):
    def __init__(self):
        self.video = cv2.VideoCapture(0)
        self.roi_start = (50, 150)
        self.roi_end = (250, 350)
        self.model = load_model('asl_model.h5') # Execute Local Trained Model
        # self.model = load_model('IBM_Communication_Model.h5') # Execute IBM
Trained Model
        self.index=['A','B','C','D','E','F','G','H','I']
        self.y = None
    def __del__(self):
        self.video.release()
    def get_frame(self):
        ret,frame = self.video.read()
        frame = cv2.resize(frame, (640, 480))
        copy = frame.copy()
```

```
        copy = copy[150:150+200,50:50+200]
        # Prediction Start
        cv2.imwrite('image.jpg',copy)
        copy_img = image.load_img('image.jpg', target_size=(64,64))
        x = image.img_to_array(copy_img)
        x = np.expand_dims(x, axis=0)
        pred = np.argmax(self.model.predict(x), axis=1)
        self.y = pred[0]
        cv2.putText(frame,'The Predicted Alphabet is:
'+str(self.index[self.y]),(100,50),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)
        ret,jpg = cv2.imencode('.jpg', frame)
        return jpg.tobytes()
```